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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/798,419	03/12/2004	Junji Katamura	040302-0386	6557

22428 7590 03/23/2007  
FOLEY AND LARDNER LLP  
SUITE 500  
3000 K STREET NW  
WASHINGTON, DC 20007

EXAMINER
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MCCRACKEN, DANIEL

ART UNIT	PAPER NUMBER
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1754

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/23/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/798,419	<b>Applicant(s)</b> KATAMURA ET AL.	
	<b>Examiner</b> Daniel C. McCracken	<b>Art Unit</b> 1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 February 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) 1-5 and 12-14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 6-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

### **DETAILED ACTION**

Citation to the Specification will be in the following format (S. #, ¶) where # denotes the page number and ¶ denotes the paragraph number. Citation to patent literature will be in the form (Inventor #, LL) where # is the column number and LL is the line number.

### ***Election/Restrictions***

Claims 1-5, 12, 13, 14 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 02/21/2007.

### ***Drawings***

The informal drawings – specifically Fig. 3 and Fig. 5 - are not of sufficient quality to permit examination. Accordingly, replacement drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to this Office action. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 6-11 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification is sufficiently lacking to demonstrate that Applicants have actually performed this "opening operation" in so far as a section other than the (more reactive) ends are opened. The figures provided are indistinguishable from any other conventional carbon nanotube sample (i.e. the "real pictures" in Figs. 3 and 5 don't match the cartoon provided in Fig. 4 – in fact, with as much as the Examiner can make out of Figs. 3 and 5, it would appear as something completely different has been done.). Further, the Examples are devoid of a gas phase oxidative treatment as required by Claims 10-11.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 6-8 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu, et al., *Fullerene Pipes*, 280 Science 1253 (1998).

With respect to Claim 6, Liu et al necessarily teaches the production of a molecule including "a space formed with a planar sheet constituted by six-membered rings of carbon atoms" and performing an opening process on the molecule. *See* (Liu "Abstract") ("Single-wall fullerene nanotubes were converted from nearly endless, highly tangled ropes into short, open-ended pipes that behave as individual macromolecules."). Notwithstanding the 35 USC §112

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issues, *supra*, Liu appears to disclose the “opening preparation process” that Applicants are claiming. *Compare* (Liu at 1254, Col 1) (“We infer that this method is effective . . . *leaving an open hole in the tube side.*”) (emphasis added) *with* (S. 10, 8-11) (“With this process, as schematically shown in FIG. 4, it was confirmed that a number of openings 3 were prepared onto the surface of the bundle of SWNT 1, and *the sidewalls 2 of the SWNT were partially opened.*” (emphasis added)).

As to Claim 7, Liu discloses a “columnar” molecule. *See* (Liu at 1254, “Fig. 2 (A and B)”). As to Claims 8-9, Liu discloses an oxidation treatment. (Liu at 1254, Col. 2) (“The 3:1 concentrated H<sub>2</sub>SO<sub>4</sub>:HNO<sub>3</sub> mixture was chosen for the oxidizing acid in this cutting operation because it is also known to intercalate and exfoliate graphite (14).”). Nitric acid and sulfuric acid are taught. *Id.* Hydrogen peroxide is also taught. *See Id.* at Col. 3. (“At 70C in a mixture of concentrated sulfuric acid and 30% aqueous hydrogen peroxide.”).

Claims 6-9 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,698,175 to Hiura et al.

With respect to Claim 6, Hiura discloses a process for opening carbon nanotubes. (Hiura 1, 44-45). As to Claim 7, “columnar” carbon nanotubes are taught. *Id.* As to Claims 8-9, an oxidative treatments employing, *inter alia* nitric acid and sulfuric acid are taught. *See generally* (Hiura Col 5-6 “Examples 2-5”).

Claims 6-9 are rejected under 35 U.S.C. 102(b) and alternatively under 35 U.S.C. 102(a)<sup>1</sup> as being anticipated by A. Zittel et al, *Hydrogen sorption by carbon nanotubes and other carbon nanostructures*, Journal of Alloys and Compounds 330-332 (2002) 676-682.

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<sup>1</sup> It is unclear when exactly this reference was published relative to the Japanese priority date. Accordingly, 102(a) and 102(b) rejections are made.

Zittel teaches a process of opening columnar carbon nanotubes with a nitric acid treatment. (Zittel at 677, Col. 2 "Experimental").

Claims 6-8 and 10-11 are rejected under 35 U.S.C. 102(b) as being anticipated by A.C. Dillon, et al., *Storage of hydrogen in single-walled carbon nanotubes*, 386 Nature 377 (1997).

With respect to Claims 6, 8 and 10-11, Dillon discloses opening carbon nanotubes by an oxidation treatment that employs an oxidative gas. Oxygen is explicitly taught. (Dillon at 378, Col. 2)

Claims 6-8 and 10-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Mawhinney, et al., *Infrared Spectral Evidence for the Etching of Carbon Nanotubes: Ozone Oxidation at 298 K*, 1225 J. Am. Chem. Soc. 2382-2394 (2000).

With respect to Claims 6, 8 and 10-11, Mawhinney discloses opening carbon nanotubes by an oxidation treatment that employs an oxidative gas. Ozone is explicitly taught. (Dillon at 2384, Col. 1) ("[T]he ozone etches away the end cap sites and proceeds down the nanotube walls.").

### ***Conclusion***

This technology is at least ten years old. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The art cited on Applicants' IDS is considered pertinent. More art rejections could have been made, but in the interest of compact prosecution, a sampling was provided.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel C. McCracken whose telephone number is (571) 272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

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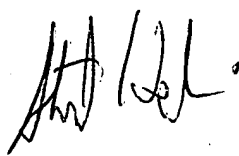
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Daniel C. McCracken

DCM



STUART L. HENDRICKSON  
PRIMARY EXAMINER